

**Botany C - Botany- Division C - Rickards Invitational Div. C - 12-05-2020**

- **Teams may have the following:**
  - One stand-alone, non-programmable, non-graphing calculator.
  - One hard copy 8.5" x 11" sheets of paper with information from any source. **Electronic notes are fine to use.**
- Partial credit will be awarded accordingly.
- If you are not certain as to what you should be doing, or if a question does not make sense to you, ask the event supervisor what to do.
- For fill-in-the-blank questions, assume your answer to be **singular** unless you're given different instructions.
- Be realistic in all of your answers. Think biologically and environmentally!
- You have 50 minutes to complete this test. Good luck!

Exam Author: Mayur Chhitu, *University of California, Riverside*, B.S., Biochemistry 2023

**1. (1.00 pts)** The classification of plants based on their adaptability to adverse climate conditions was created by:

- A) Theophrastus
- B) Valerius Cordus
- C) Carl Linnaeus
- D) Cristen Raunkiær
- E) Charles Darwin

**2. (1.00 pts)** The German scientist who coined the word “Pharmacognosy” in his work title “Analecta Pharmacognostica” in 1815 was:

- A) C.A. Seydler
- B) Theophrastus
- C) Carl Linnaeus
- D) Joseph Hooker

**3. (1.00 pts)** The quote, “Medicine sometimes grants health, sometimes destroys it, showing which plants are helpful, which do harm.”, comes from which book:

- A) *Historia Plantarum*
- B) *De Materia Medica*
- C) *De causis plantarum*
- D) *Tractatus de Herbis*

**4. (1.00 pts)** In water-stress conditions, which plant hormone is responsible for closing stomata?

- A) Abscisic acid
- B) Gibberellin
- C) Cytokinin
- D) Auxin

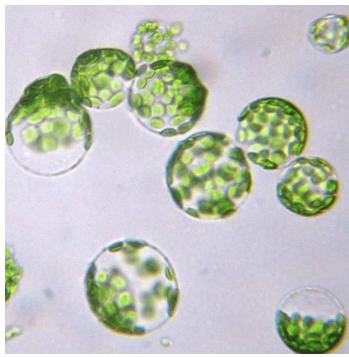
**5. (2.00 pts)** Which of the following constitutes cytokinin function?

(Mark **ALL** correct answers)

- A) Stimulates the growth of lateral buds
- B) Stimulation of chlorophyll synthesis
- C) Promotes leaf senescence
- D) Promotes phosphorylation

**6. (2.00 pts)** Spores and zygotes that develop into whole plants is an example of:

- A) Plasticity
- B) Totipotency
- C) Polyploidy
- D) Multipotency

**7. (1.00 pts)** The following image shows which of the following:

- A) Chloroplast
- B) Protoplast
- C) Chromoplast
- D) Leucoplast

**8. (2.00 pts)** Name one enzyme that will prepare a plant cell to look like the above image.**9. (3.00 pts)** Follow the following plant sequence and recall the term that describes “1”, “2”, and “3” **in order**:

- 1. Pollen tube enters the ovule from the micropylar end.
- 2. Pollen tube enters via the integuments.
- 3. Entering of pollen tube from chalaza.

**10. (2.00 pts)** Which of the following auxin in higher concentration is used as selective weedicide?

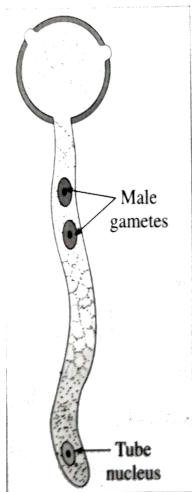
- A) Naphthal acetic acid
- B) 2,4-Dichlorophenoxyacetic acid
- C) N,N diphenyl urea
- D) 2-Naphthoxyacetic acid

**11. (2.00 pts)** Place of integument origin in plants:

- A) Raphe
- B) Placenta
- C) Endostome
- D) Chalaza
- E) None of the above

**12. (3.00 pts)**

The following image shows male gametes of an angiosperm traveling from a pollen tube into the female gamete. This was possible via wind-borne pollination. Give the biological terms for the male gametes, female gametes, and this process of plant reproduction (specific term, not sexual reproduction).



**13. (1.00 pts)** Let's say there are 20 chromosomes present in a moss plant. What are the number of chromosomes in seta, leaf and calyptra, respectively.

- A) 40, 10, 20
- B) 10, 40, 20
- C) 40, 20, 20
- D) 20, 10, 20

**14. (2.00 pts)** Name one animal that consumes tubers.

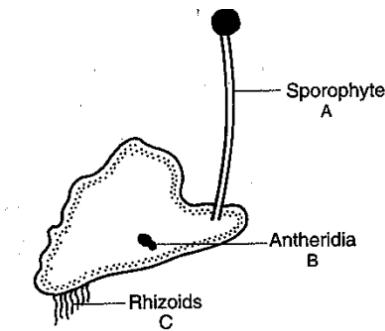
**15. (1.00 pts)**

Which of the following algae matches this description: Non-differentiated cells, no chlorophyll-a, no phycocyanin within their cells, and no flagellated stages in their life cycles, not made of silica.

- A) Green algae
- B) Brown algae
- C) Red algae
- D) Diatoms

**16. (1.00 pts)**

The following image is of a random moss. Which of the following ploidy levels is correct based on the indicated structures and your prior knowledge on its life cycle?



- A) A = n; B = 2n; C = n
- B) A = 2n; B = n; C = 2n
- C) A = 2n; B = 2n; C = 2n
- D) A = n; B = n; C = n

**17. (1.00 pts)** Which of the following descriptions about vascular bundles of monocot stem is correct?

- A) Closed, collateral, endarch vascular bundles
- B) Open, collateral, endarch vascular bundles
- C) Open, collateral, exarch
- D) Closed, collateral, exarch

**18. (2.00 pts)**

Self-fertilization is undesirable because it limits genetic variation and the possibility for organisms to adapt to certain environments. Surface proteins help recognize similar gametes to avoid such reproduction. So which of the following types of sexual reproduction is being avoided?

- A) Heterogamy
- B) Oogamy
- C) Isogamy
- D) Polypogamy

**19. (2.00 pts)** Which of the following crops matches this general description: Does not possess an apical bud at the tip and can store starch and glucose.

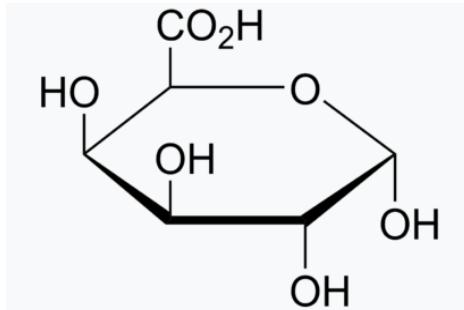
- A) Tulips
- B) Daffodils
- C) Hyacinths
- D) Dahlias

**20. (2.00 pts)**

Early organisms on this planet generated energy through chemolithotrophic metabolism, when there was no oxygen present in the soil. The following equation is incomplete. Complete it including the correct **coefficients, subscripts, and states of matter**:

**21. (2.00 pts)** Which of the following choices match the statement: Derived from a flower with a united carpel that splits into two or more one-seeded segments.

- A) Achene
- B) Nut
- C) Samara
- D) Nutlet
- E) Schizocarp

**22. (2.00 pts)** What is the ratio of Chl-a to Chl-b in chloroplast?
**23. (2.00 pts)** The following image is a main component for an edible delicacy:

- A) Uronic acid
- B) D-Galacturonic acid
- C) Acetylneuraminic acid
- D) Xylan

**24. (1.00 pts)** What percentage of lignin is found in dry wood?

- A) 10%
- B) 20%
- C) 30%
- D) 50%

**25. (2.00 pts)** How many photons are required for green algae to perform photosynthetic “water-splitting”?

- A) 2
- B) 4
- C) 6
- D) 8

**26. (6.00 pts)** Which of the following herbicides is selective? **Nonselective**?

- 2,4-Dichlorophenoxyacetic Acid
- Atrazine
- DCMU
- MCPA
- Paraquat
- Glyphosate

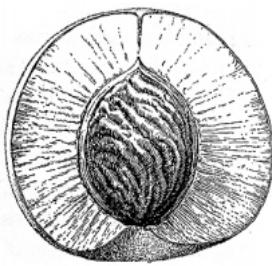
**27. (1.00 pts)** Which of the following describes the importance of flowering:

- A) Dispersal of seeds
- B) Forming large number of fruits
- C) Attracting insects for cross pollination
- D) Release of pollen grains

**28. (2.00 pts)** Which of the following plants reduces hypertension?

- A) *Aconitum chasmanthum*
- B) *Solanum nigrum*
- C) *Centella asiatica*
- D) *Rouwolia serpentina*

**29. (2.00 pts)** Which of the following fruit types describes the following image:



- A) Achenes
- B) Pepo
- C) Drupelets
- D) Drupe

**30. (4.00 pts)** **Describe** blanching in terms of vegetable growing, not as a cooking technique. **Give** one benefit and one con to blanching.

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**31. (3.00 pts)** **What** agricultural technique has been performed in the following image of a potato farm? **Describe** the process and how it relates to blanching.



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**32. (4.00 pts)**

Weeds are considered opportunistic and grow when conditions are favorable, such as specific temperatures, lawn moisture levels, bare or thin turf areas, and can even grow in cracks in the roads, sidewalks or driveways.

**Describe** two cultural practices of creating a weed-free lawn. Spraying herbicides is not a cultural practice.

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33. (2.00 pts) Identify the following image and be as specific as you can:



34. (2.00 pts) Identify the following disease in this image:



35. (2.00 pts) Describe its causation and how it's spread.

36. (2.00 pts) Which of the following disease is caused by bacteria?

- A) Apple scab
- B) Curly top
- C) Dutch elm
- D) Aster yellows

37. (4.00 pts) Study the following lists and match them correctly:

- A. Siphonogamy and zooidogamy
- B. Fossil (living)
- C. Liverworts
- D. Double fertilization

- I. Amphibians of plant kingdom
- II. Peanuts
- III. Ginkgo
- IV. Cycas
- V. Laminaria

38. (2.00 pts) What agricultural technique is the farmer performing throughout her potato farm?



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39. (1.00 pts) Which of the following is a living simple tissue involved as strengthening tissue for the plant body?

- A) Parenchyma
- B) Endodermis
- C) Collenchyma
- D) Cambium
- E) Pericycle

40. (2.00 pts) The channels of protoplasm that exists through cell walls that connect one cell to another and function like gap junctions are:

- A) Stomata
- B) Guard cells
- C) Amyloplasts
- D) Middle lamellae
- E) Secondary wall

41. (1.00 pts) The initiation of seed germination requires:

- A) Guttation
- B) Transpiration
- C) Phototropism
- D) Imbibition
- E) All of the above

**42. (1.00 pts)** Cacti have traditional leaves just like any typical angiosperm does.

- True    False

**43. (2.00 pts)** Identify the disease seen in the following image:



**44. (2.00 pts)**

You noticed this disease in the leaves of your apple plants and suspect that there is a bacterial infection affecting the plant's vasculatures. **Which** vasculature system is predominantly affected and **why**?

**45. (2.00 pts)** Select the **true** statement(s) about the nitrogen cycle.

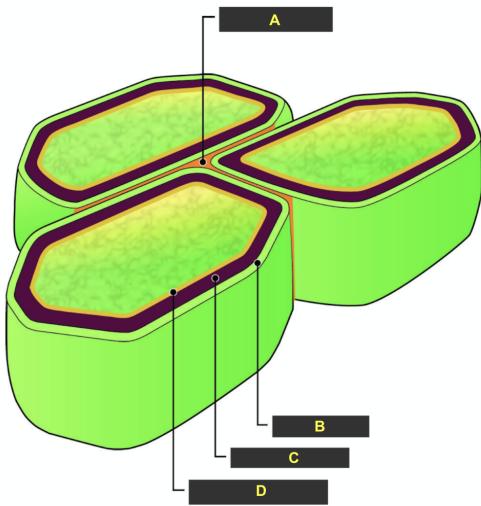
(Mark **ALL** correct answers)

- A) When plants and animals die, nitrogen is removed from the nitrogen cycle.
- B) The nitrogen cycle requires different types of bacteria.
- C) Nitrogen gas is converted to nitrates in plant leaves.
- D) Nitrogen cannot be cycled through living organisms.

**46. (2.00 pts)** Describe how do maize and orchids decrease their incidence of photorespiration.

**47. (6.00 pts)** List and describe four categories of plant disease symptoms based on your knowledge on phytopathology.

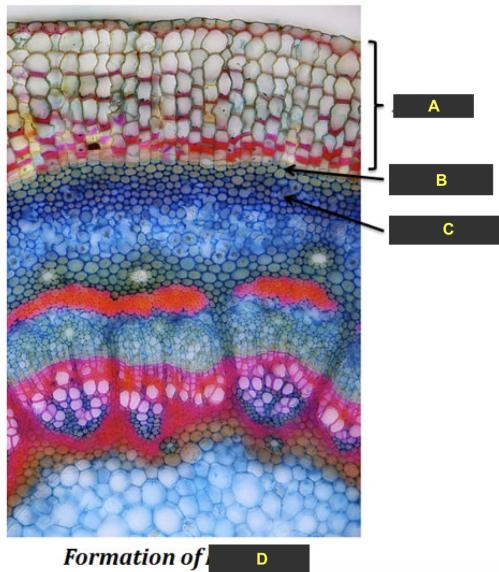
48. (2.00 pts) Identify "A", "B", "C", and "D" as seen in the following image of adjoining plant cells:



49. (2.00 pts) Which of the following elements is present in "A"?

- A) Zn
- B) Ca
- C) Cu
- D) K

50. (4.00 pts) Identify "A", "B", "C", and "D" as seen in the following image of a vascular plant tissue sample:



51. (3.00 pts)
- Which defined letter gives rise to cork tissues.
  - Give two items that are made from *Quercus suber*.

52. (1.00 pts) Which of the following plant cell organelles is responsible for drug detoxification and a site for lipid synthesis?

- A) Smooth ER
- B) Rough ER
- C) Golgi Apparatus
- D) Mitochondrion

53. (3.00 pts) What does VAM stand for?

People in your town complain about how **some** of their local pineapples and papayas tasted **candied** (sugary/syrupy), not rich in **honey**. You are concerned about this and therefore conduct an experiment that tests to distinguish between the honey-processed pineapples and papayas versus the supposed sugar-processed pineapples and papayas that were imported to your local market from Malaysia. To start, you personally order a batch of 100 pineapple and papaya samples (possibly mixed) from the Malaysian company with approval from the U.S. Customs Service. You also have tabular values of C<sub>3</sub>, C<sub>4</sub>, CAM plants (e.g. sugarcane, corn) to refer to when drawing your conclusion.

**Materials:**

- Mass spectrometer
- Papayas and Pineapples
- EtOH (Ethanol)
- Blender
- Vacuum oven
- Cutting utensils and measuring equipment

54. (8.00 pts)     • What type of carbon metabolism do pineapples and papayas function in (C<sub>3</sub>, C<sub>4</sub>, CAM)?  
                   • Describe how this relates to **facultative CAM**.  
                   • Describe what you are biologically comparing in your experiment to determine the validity of your local honey-processed fruits.  
                   • Describe how you will conduct this experiment.

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55. (4.00 pts)    Describe one benefit and one issue behind knockdown herbicides.

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56. (4.00 pts)     • What are LHC's?  
                   • What are they mostly made out of?  
                   • Explain why Photosystem I has fewer LHC's than Photosystem II.

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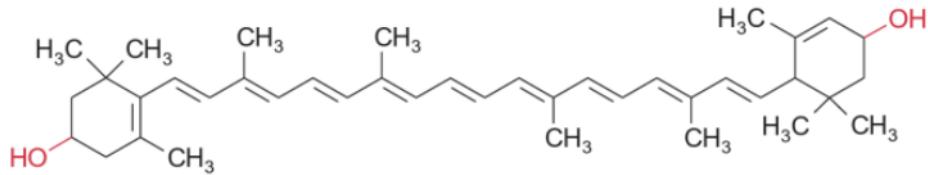


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57. (2.00 pts)     • Identify the following compound.




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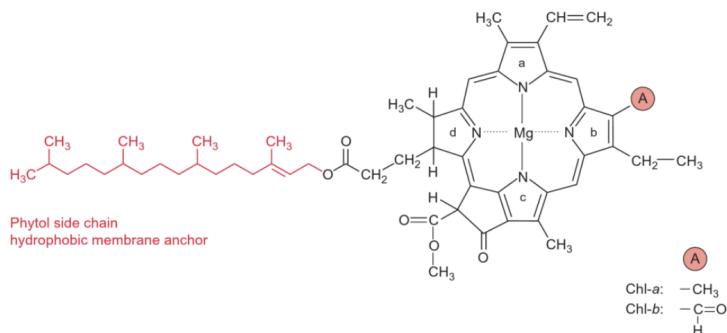


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58. (2.00 pts)    The basic structure on the left formed by combined chlorophyll-a and chlorophyll-b rings below is called?



59. (3.00 pts)
- Identify the type of derivatives formed by lignin polymerization.
  - Give two examples.

60. (2.00 pts)

Isolated from neighboring tissue, these plant cells are known to potentially contain poisonous CaC<sub>2</sub>O<sub>4</sub>. Answer written in plural form. Do not include the word "cell" or "cells" in your answer.

61. (2.00 pts) What is the edible item from Question 23 that some consume for breakfast?

62. (4.00 pts) Contextualize the following floral formula:

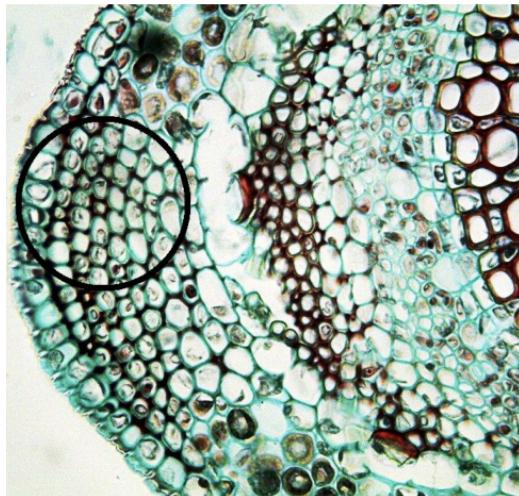
- What does each letter and number represent and mean?
- What does the curved line represent?

A5G2

63. (5.00 pts) Interpret the following floral formula:  $\% \varnothing K_3 C_4 A_{(2+2)} G_{(2)}$

**Hint:** Go from left to right, denoting all adjacent letters, numbers, and symbols. Use individual and collectively-named plant parts when needed.

64. (2.00 pts) Identify the type of plant cells based on the following image (Do not include the word “cell” or “cells” in your answer):



65. (2.00 pts) Describe how the xylem will stop water transportation if needed right before the winter season arrives.

66. (2.00 pts) Hypothesize why tubers, a type of stem modification, arose in our natural environment.

67. (2.00 pts) What are the small white growths as seen in the following image?



The following image pertains to this xylem/phloem differentiation chart.

Word Bank: Sugar, Water, Up, Down, Small, Big. All-or-No points for each question.

68. (2.00 pts)

	<b>Xylem</b>	<b>Phloem</b>
Contains mostly	Dead cells	Living cells
Transports	1	4
Direction	2	5
Biomass	3	6

- Identify “1”, “2”, “3” using the Word Bank.
- Identify “4”, “5”, “6” using the Word Bank.

- Congratulations, you have finished the botany examination.
- Feel free to fill out this test feedback survey: [tinyurl.com/RateMySciolyTests](http://tinyurl.com/RateMySciolyTests) (<http://tinyurl.com/RateMySciolyTests>).
- Email: [mayurchhitu@gmail.com](mailto:mayurchhitu@gmail.com)